

Linear Functions

Create a table of values for each of these functions

$$y=3x$$

x	y
-3	-9
-2	-6
-1	-3
0	0
1	3
2	6
3	9

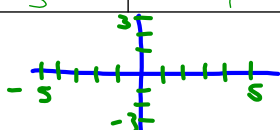
1st Diff

$$\begin{aligned} -6 - (-9) &= 3 \\ -3 - (-6) &= 3 \\ 0 - (-3) &= 3 \\ 3 - 0 &= 3 \\ 6 - 3 &= 3 \\ 9 - 6 &= 3 \end{aligned}$$

$$y=2x+4$$

x	y
-3	-2
-2	0
-1	2
0	4
1	6
2	8
3	10

$$\begin{aligned} 0 - (-2) &= 2 \\ 2 - 0 &= 2 \\ 4 - 2 &= 2 \\ 6 - 4 &= 2 \\ 8 - 6 &= 2 \\ 10 - 8 &= 2 \end{aligned}$$



$$y=5$$

x	y
-3	
-2	
-1	
0	
1	
2	
3	

$$x=6$$

x	y
6	-3
6	-2
6	-1
6	0
6	1
6	2
6	3

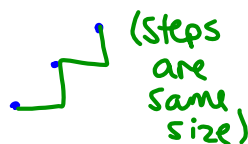
How can we tell we have a line?

Table

1st differences
must be the
SAME!

Graph

- looks like
a line
- dots look like
a staircase



Equation

- degree has to
be 1.

- exponents
can ONLY be
+1

$$\begin{aligned} y &= x^2 + 4 \\ y &= 3x - 9 \\ y &= \frac{1}{x} (x-1) \end{aligned}$$



Quadratic Functions

Create a table of values for each of these functions

$$y=x^2$$

x	y	1 st Diff	2 nd Diff
-3	9		
-2	4	$4-9=-5$	
-1	1	$1-4=-3$	
0	0	$0-1=-1$	
1	1	$1-0=1$	
2	4	$4-1=3$	
3	9	$9-4=5$	
			$-1-(-3)=2$
			$1-(-1)=2$
			$3-1=2$
			$5-3=2$

$$y=x^2+4$$

x	y
-3	13
-2	8
-1	5
0	4
1	5
2	8
3	13

$$y=5x^2$$

x	y
-3	45
-2	20
-1	5
0	0
1	5
2	20
3	45

$$y=6x^2-3$$

x	y

How can we tell we have a quadratic?

Table

2nd differences
are constant

Equation

x^2 in the
equation

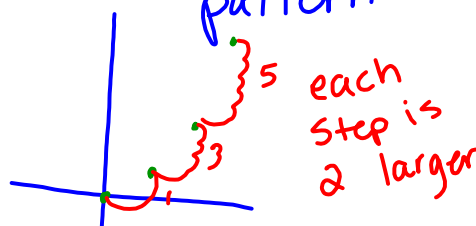
$$y = x^2 + 2 \quad \text{YES}$$

$$y = -x^2 - 7 \quad \text{YES}$$

$$y^2 = x^2 \quad \text{NO}$$

Graph

- Symmetrical
- check step pattern



Exponential Functions

Create a table of values for each of these functions

$$y=2^x$$

x	Y
3	$2^3 = 8$
2	$2^2 = 4$
1	$2^1 = 2$
0	$2^0 = 1$
-1	$2^{-1} = \frac{1}{2}$
-2	$2^{-2} = \frac{1}{4}$
-3	$2^{-3} = \frac{1}{8}$

$$2^{-1} = \frac{1}{2^1}$$

1st Diff

$$4 - 8 = -4$$

$$2 - 4 = -2$$

$$1 - 2 = -1$$

$$\frac{1}{2} - 1 = -\frac{1}{2}$$

$$\frac{1}{4} - \frac{1}{2} = -\frac{1}{4}$$

$$\frac{1}{8} - \frac{1}{4} = -\frac{1}{8}$$

$$y=3^x+4$$

Ratio Test

$$\frac{8}{4} = 2$$

$$\frac{4}{2} = 2$$

$$\frac{2}{1} = 2$$

$$\frac{1}{2} = 2$$

$$\frac{1}{4} = 2$$

$$\frac{1}{8} = 2$$

$$\frac{1}{16} = 2$$

$$\frac{1}{32} = 2$$

$$\frac{1}{64} = 2$$

$$\frac{1}{128} = 2$$

$$\frac{1}{256} = 2$$

$$\frac{1}{512} = 2$$

$$\frac{1}{1024} = 2$$

$$\frac{1}{2048} = 2$$

$$\frac{1}{4096} = 2$$

$$\frac{1}{8192} = 2$$

$$\frac{1}{16384} = 2$$

$$\frac{1}{32768} = 2$$

$$\frac{1}{65536} = 2$$

$$\frac{1}{131072} = 2$$

$$\frac{1}{262144} = 2$$

$$\frac{1}{524288} = 2$$

$$\frac{1}{1048576} = 2$$

$$\frac{1}{2097152} = 2$$

$$\frac{1}{4194304} = 2$$

$$\frac{1}{8388608} = 2$$

$$\frac{1}{16777216} = 2$$

$$\frac{1}{33554432} = 2$$

$$\frac{1}{67108864} = 2$$

$$\frac{1}{134217728} = 2$$

$$\frac{1}{268435456} = 2$$

$$\frac{1}{536870912} = 2$$

$$\frac{1}{1073741824} = 2$$

$$\frac{1}{2147483648} = 2$$

$$\frac{1}{4294967296} = 2$$

$$\frac{1}{8589934592} = 2$$

x	Y

Exponential

$$y=5^x-3$$

x	y

$$y=2^{x+1}$$

x	y

How can we tell we have a exponential?